Department of Health Services

Solution Alternatives, Evaluation & Recommendations

834 – Benefit Enrollment and Maintenance

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Version 1.0

FINAL

Document History (Version Control)

Version	Date	Author	Brief Description of Modifications
1.0	12/29/03	Jon Lazaro; Joey Lawhorn	Final Distribution Copy
2.8	1/13/04	Jon Lazaro	Changes to bring 820 and 834 in sync

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Executive Summary

Scope

The scope of the Department of Health Services 834 Transaction project is to find the optimal end-to-end solution, at the best value, for delivering benefit enrollment and disenrollment information in a format that has been mandated by the Health Insurance Portability Act (HIPAA) of 1996.

Currently, the Fiscal Intermediary Access to Medi-Cal Eligibility (FAME) file is the primary source of member enrollment and disenrollment information utilized by Health Plans to update their systems. Information Technology Services Division (ITSD) performs the FAME file extracts and places the data within the Health and Human Services Data Center (HHSDC) for retrieval by the County Organized Health Systems (COHS). For the Non County Organized Health Systems Plans (NCOHSP), which consists of multiple models, ITSD performs the FAME file extracts and transmits the enrollment data to EDS for retrieval by the health plans.

Project Phases

The 834 project is executed in accordance with the OHC Project Management Plan that defines the following five phases for each end-to-end HIPAA Compliance project:

1. Project Planning
2. Assessment of the current business and technical environments
3. Gap analysis and requirements definition
4. Design specifications
5. Remediation and implementation

The definition of Solution Alternatives as described in this document is one of the final deliverables in the Gap Analysis phase.

Status of Project Completion

The Project has progressed according to the established project plan. Program Areas have provided signoff on the following deliverables:

Project Phase	Deliverable	Date Approved
Assessment	Business Assessment	10/20/2003
Assessment	Technical Assessment	10/17/2003
Assessment	Integrated Assessment	10/24/2003
Gap Analysis & Requirements	Business & Technical Requirements	12/09/2003

Alternatives

Four categories of solutions were evaluated as alternatives for delivering Benefit Enrollment and Disenrollment data:

- Use services of a third-party clearinghouse
- Utilize an available in-house translator
- Integrate extract, transform, load (ETL) software
- Develop custom translator

The option of retaining all current business and system processes is also discussed as a potential contingency solution.

Clearinghouse solutions were deemed less attractive due to either a lack of product offering, or the high cost. Clearinghouses have not been on the leading edge of HIPAA development and have concentrated their resources on the large-profit generating formats such as delivery of claims submittal at the exclusion of benefit enrollment formats.

Translators were strongly considered but were not selected based on the current issues with implementation and future operational complexity. This complexity can be attributed to new technologies that are constantly under development and subject to change.

Developing a custom legacy translator is not considered viable due to the current lack of resources and high implementation costs

Recommended Solution

It is recommended that DHS **pursue the integration of ETL software**. In doing so the high costs and inherent risks associated with other methodologies would be avoided. Further, using ETL software would provide a vehicle for converting to other HIPAA mandated transaction formats at a reduced cost and shortened implementation time frame.

The first-year financial outlay for this solution would be approximately $169,000 based on acquiring both third-party software and client/server hardware, and securing a vendor to perform the development and implementation. More detailed financial breakouts are provided in Attachment A – Detailed Six-Year Projected Costs and Attachment B – Six-Year Projected Cost Trends.

Next Steps

The next phase, *Design Specifications*, will provide the opportunity for the 834 Project Analysts to document in detail how to accomplish the approved solution from a technical perspective. The *Technical Specifications* document details each change necessary to the systems, application programs, file layouts, data elements, reports, tables, screens, and technical communication protocols to accommodate HIPAA 834 Transaction compliance.

1 Scope

1.1 Scope Definitions and Limitations

The goal of the 834 Transaction Project solution alternatives is to apply an appropriate level of due diligence in identifying the optimal business and technical solutions available to comply with HIPAA requirements. This document conceptualizes and presents alternative technical solutions based on the accumulated body of knowledge amassed in prior phases (i.e., Assessment, Requirements and Gap Analysis). Each alternative is weighed and presented based on merits of benefits, costs, risks, and time to implement. Recommendations are offered based on the cumulative merits of each alternative solution.

This document is limited in scope to presenting viable alternatives that meet HIPAA requirements for the 834 Transaction that will be used to deliver *only* benefit enrollment and disenrollment information. The data source for the 834 Transaction is primarily the Fiscal Intermediary Access to Medi-Cal Eligibility (FAME) Extract file that includes not only enrollment data but also eligibility and payment data. Eligibility and payment data are not incorporated in the 834 Transaction and may be available in other HIPAA Transactions or in some other supplemental file format should the current FAME extract be discontinued.

Some alternatives documented here may also apply to other HIPAA transaction sets currently under development by Department of Health Services (DHS). Considerations such as scalability, ease of maintenance, and single-source solution must be taken in context when determining a solution that is workable for all.

The basis for these solution alternatives is to ultimately deliver HIPAA compliant transactions to health care plans. Transactions may be generated in one of two ways based on being compliant or non-compliant.

Compliant Transaction

A compliant transaction is one delivered to a covered entity that falls within the definition of HIPAA for Transaction Sets **and** meets all seven Types of Workgroup for Electronic Data Interchange/Strategic National Implementation Process (WEDI/SNIP) Testing for HIPAA:[1]

- Type 1 - integrity testing

[1] *Transaction Compliance and Certification, A White Paper Describing the Recommended Solutions for Compliance Testing and Certification of HIPAA Transactions*, WEDI SNIP Transactions Workgroup – Testing Sub Work-Group, 08/26/02 - [http://www.snip.wedi.org].

- Type 2 - requirement testing
- Type 3 - balance testing
- Type 4 - situational testing
- Type 5 - code set testing
- Type 6 - product or services testing
- Type 7 - guide-specific testing

The following is an excerpt from the WEDI/SNIP white paper defining each type of testing.

> **Type 1: *EDI syntax integrity testing*** – Testing of the electronic data interchange (EDI) file for valid segments, segment order, element attributes, testing for numeric values in numeric data elements, validation of X12 or NCPDP syntax, and compliance with X12 and NCPDP rules. This will validate the basic syntactical integrity of the EDI submission.
>
> **Type 2: *HIPAA syntactical requirement testing*** – Testing for HIPAA Implementation Guide-specific syntax requirements, such as limits on repeat counts, used and not used qualifiers, codes, elements and segments. Also included in this type is testing for HIPAA required or intra-segment situational data elements, testing for non-medical code sets as laid out in the implementation Guide, and values and codes noted in the Implementation Guide via an X12 code list or table.
>
> **Type 3: *Balancing*** – Testing the transaction for balanced field totals, financial balancing of claims or remittance advice, and balancing of summary fields, if appropriate. An example of this includes items such as all claim line item amounts equal the total claim amount. (See pages 19-22, *Healthcare Claim Payment/Advice – 835 Implementation Guide for balancing requirements of the 835 Transaction*.)
>
> **Type 4: *Situation testing*** – The testing of specific inter-segment situations described in the HIPAA Implementation Guides, such that: If A occurs then B must be populated. This is considered to include the validation of situational fields given values or situations present elsewhere in the file. Example: if the claim is for an accident, the accident date must be present.
>
> **Type 5: *External code set testing*** – Testing for valid Implementation Guide-specific code set values and other code sets adopted as HIPAA standards. This level of testing will not only validate the code sets but also make sure the usage is appropriate for any particular transaction and appropriate with the coding guidelines that apply to the specific code set. It validates external code sets and

tables such as CPT, ICD9, CDT, NDC, status codes, adjustment reason codes, and their appropriate use for the transaction.

Type 6: *Product types or line of services* - This testing type is required to ensure that the segments/records of data that differ based on certain healthcare services are properly created and processed into claims data formats. These specific requirements are described in the Implementation Guides for the different product types or lines of service. For example, ambulance, chiropractic, podiatry, home health, parenteral and enteral nutrition, durable medical equipment, psychiatry, and other specialized services have specific requirements in the Implementation Guide that must be tested before putting the transaction in production. This type of testing only applies to a trading partner candidate that conducts transactions for the specific line of business or product type.

Type 7: Implementation Guide-Specific *Trading Partners* - The Implementation Guides contain some HIPAA requirements that are specific to Medicare, Medicaid, and Indian Health. Compliance or testing with these payer specific requirements is not required from all trading partners. If the trading partner candidate intends to exchange transactions with one of these Implementation Guide special payers, this type of testing is required. When a certification service certifies a trading partner for compliance, the certification service must indicate whether these payer specific requirements were met during the certification process. Other payers and trading partners may have their own specific business requirements; but, unless they are listed in the HIPAA Implementation Guides, they are not HIPAA requirements. These non-HIPAA trading partner specific requirements must be tested as part of the business-to-business testing. For further information on business-to-business testing and for further information on testing trading partner rules that are not contained in the Implementation Guides, please see the Business-To-Business Testing White Paper developed by this sub-workgroup.

Non-compliant Transaction

A non-compliant transaction is one that does not meet every one of the above testing criteria. The rationale for presenting a non-compliant alternative is to offer a potential contingency solution.

1.2 Impact on Medi-Cal Managed Care Division

The Medi-Cal Managed Care Division (MMCD) is the only Program Area within DHS to be directly affected by the 834 Transaction. The ability to be seamlessly integrated into a production environment with minimal disruption to business-as-usual for MMCD was a primary consideration when evaluating potential solutions.

Additionally, the identified solutions all have been introduced through discussions with the Medical and Dental Plans that participate in the DHS OHC Plan 820/834 Sub Workgroup. The 820/834 Sub-Workgroup has reacted favorably to the research and findings of DHS.

2 Solution Alternatives Discussion

In addition to the continued use of the current business and system processes (the status quo), four generalized solution alternatives were pursued that could best satisfy the needs of DHS to become HIPAA compliant in its ability to deliver Benefit Enrollment and Disenrollment data. The alternatives are categorized based on type of service offering or product functionality and several options were considered in each category. The alternative solutions are to:

- Utilize the services of a clearinghouse
- Use an in-house translator
- Integrate ETL software
- Develop custom legacy translator

As a means to expedite the solution alternatives discovery process, inquiries were made to other State Medicaid programs and Health Plans soliciting input used in their developmental solutions.

Table 1 is a listing of State Medicaid programs and Health Plans that responded to DHS inquiries regarding product or service provider references.

Table 1 – Solution Options and Product References

						Compliance Checking		Translation Tool		
Responder	**834**	**820**	**835**	**837**	**Clearing House**	**Company**	**Tool**	**Company**	**Tool**	**Comment**
SafeGuard Dental & Vision					n/a			Inovis	TrustedLink iSeries	Formerly Peregrine Systems
Arizona Health Care Cost Containment System	X	X			n/a			Ascential Software *	Mercator	In production 10/1/2003
Missouri Medicaid			X	X	n/a			Ascential Software *	Mercator	Long run times - support issues with Mercator Software, Inc. (See note)
New Mexico	X	X			n/a	Edifecs	Xengine	Microsoft	BizTalk	
Blue Cross					n/a			Pervasive Software **	djCosmos	Formerly Data Junction
Community Health Group	X				n/a			Sterling Commerce	Gentran	Version: Diamond 950 v 7.61
Delta Dental					n/a			Sterling Commerce	Gentran	
Western Dental Services					n/a			Sterling Commerce	Gentran	High learning curve - long development time

						Compliance Checking		Translation Tool		
Responder	**834**	**820**	**835**	**837**	**Clearing House**	**Company**	**Tool**	**Company**	**Tool**	**Comment**
CalOptima					n/a	Claredi		TriZetto Group	HIPAA Gateway	
Florida	X				Affiliated Computer Systems (ACS)			n/a	n/a	In bound and outbound
Inland Empire Health Plan	X				n/a			n/a	In-house	Developed in-house translator
Blue Shield of California						Claredi				
Vision Service Plan						Claredi				
								* Ascential Software acquired Mercator Software, Inc. in September 2003		
								** Pervasive Software acquired Data Junction in December 2003		

2.1 Utilize the Services of a Clearinghouse

2.1.1 Description

Clearinghouses provide an end-to-end (E2E) service of receiving proprietary files and translating those files into HIPAA compliant files. Once the files are converted the clearinghouse then provides the compliant transaction file to the appropriate health plan. The value added by a clearinghouse is in providing ancillary services other than data translation. Additional services provided may include:

- Systems connectivity
- Compliance checking
- Hosting services
- Trading partner enablement
- Secure transaction delivery

There is usually a one-time setup fee and then ongoing maintenance and per transaction costs associated with a clearinghouse solution. Negotiated contract commitments usually span several years.

Setup Fees - Setup fees encompass establishing linkages to existing health plans, also known as trading partners, and translation code modification. Trading partner setups are necessary in order to exchange HIPAA Transactions between CA-DHS and health plans and may be accomplished any time a new health plan is brought under the fold of electronic transaction delivery.

Translation code modification is the enablement of the clearinghouse software to interpret proprietary data and convert it to the HIPAA Transaction. This requires the clearinghouse to fully understand the format, structure and purpose of the proprietary file.

Maintenance Fees - Ongoing maintenance fees are usually categorized as base-line monthly charges and per transaction fees. The base-line usage is charged for using the services of the clearinghouse and can be estimated as a consistent charge over the life of the contract. The per transaction fees apply to each transaction that is processed and delivered to a health plan.

Several factors may cause transaction costs to fluctuate over the life of a contract. One factor is the transaction volume processed in a given period. Pre-set price points are established and are generally based on volume and timing. As the transaction volume increases the price per transaction tends to decrease. Timing may also be considered in these fees where system utilization and delivery to process transactions may be higher during peak business hours as opposed to lower cost to process and deliver transactions during off-peak hours.

Other charges that may be incurred stem from modifications to the translation code if the proprietary file changes.

2.1.2 Considerations for Use

Using a clearinghouse approach shifts the development, maintenance, and processing from an in-house organization to an external entity. The involvement of DHS staff in development activities would be far less than the involvement they would exercise in extending existing legacy systems. Program Areas would be required, on a small scale, to work with the clearinghouse to define and clarify data formats and mappings.

Several approaches were undertaken to find a clearinghouse solution:

- Direct contact with clearinghouses
- Solicit other State Medicaid programs for clearinghouse references
- Solicit Health Plans for clearinghouse references

2.1.3 Direct Contact with Clearinghouses

A list of national clearinghouses was compiled based on their having a significant presence in the clearinghouse marketplace. From this list further information was garnered from company websites and telephone contact with clearinghouse representatives. During this investigation, it was found that commercial clearinghouses target a specific niche. That niche is defined as providing a service with the highest revenue stream. Along with the one-time implementation cost of configuring trading partners, and implementing transaction mappings, the ongoing *per transaction fee* is the greatest source of revenue. Therefore, the national clearinghouses have concentrated their efforts in promoting claims submittal transaction types that are typically high volume transactions. The 834 Transaction is not considered a high volume transaction.

Another consideration that clearinghouses use in determining which transaction to support is the data delivery mechanism. In recent years clearinghouses have migrated to web-based methodologies for transaction collection and delivery. From a provider's perspective it is much easier to enter and send data at the time of service (real-time) rather than bundle all activity and forward at a later time (batch). The front-end for entering data is usually provided by the clearinghouse and relieves the provider of any front-end technology issues.

Of the clearinghouses contacted, most did not support the low-volume benefit enrollments activities required by DHS. Only two national clearinghouses were considered as viable options, Northrop-Grumman and Electronic Data Systems (EDS).

Northrop-Grumman manages the Department of Defense (DoD) Electronic Business Exchange (DEBX) Federal Clearinghouse under long-term contract. The DoD provides the business hardware and firmware environment to conduct electronic data interchange (EDI). This is available at no cost to the user. Identified costs would be

initial setup and development charges to develop the maps and to connect DEBX to DHS. Currently, DoD / Northrop-Grumman does not provide any health care related clearinghouse services. Medicaid references provided were unsubstantiated.

The EDS E.business Exchange (EBX) is a reliable, secure, and flexible electronic transaction switching and clearinghouse infrastructure. It serves as a gateway to and from legacy systems, providing HIPAA-compliant data translations for affected transactions. The EBX solution offers the batch and interactive business-to-business transaction routing; any-to-any translation and editing services; connectivity to major value added networks (VANs); and standard and custom transaction audit and tracking reports. EDS service offering provides comprehensive system and network support; 24x7 system availability; and help desk services. In addition, EDS understands health care. They have 40 years of experience in health care technology. Furthermore, EDS has Medicaid experience, more specifically, Medi-Cal experience as the Fiscal Intermediary (FI).

2.1.4 Solicit Other State Medicaid Programs for Clearinghouse References

The National Medicaid Electronic Data Interchange HIPAA Workgroup (NMEH) subscriber list was used as a contact source for state Medicaid programs personnel. From this list, inquiries were then made to state Medicaid programs for their experience with clearinghouses. Florida stated they use their FI, Affiliated Computer Services (ACS) to process both inbound and outbound 834 Transactions. Further investigation into ACS shows they provide clearinghouse services to Medicaid programs in Iowa, Colorado, Mississippi, Washington, West Virginia and Wyoming.

Discussions were held with ACS representatives to determine whether they could provide clearinghouse services to DHS for the 834 Transaction. ACS has the capability for not only the 834 Transaction but also other HIPAA transactions such as the 820 Transaction and 270/271 Transactions. ACS operates on the standard pricing model for EDI clearinghouses; that is, there are one-time translation development costs and trading partner setup fees coupled with ongoing *per transaction fees* that are scaled to both transaction volume and length of contract commitment.

2.1.5 Solicit Health Plans for Clearinghouse References

Telephone and email inquires were made to members of the CA-DHS Medi-Cal 820/834 Sub-workgroup soliciting their experiences with clearinghouse opportunities. Responses from the Sub-workgroup indicated that the participating health plans were not using clearinghouse services.

2.2 Use an In-House Translator

2.2.1 Description

A translator is a software application that may be installed on the front-end or back-end of legacy systems to convert data from one format to another. The ASC X12N transaction formats mandated by HIPAA differ substantially from the transaction formats currently used in the health care industry. For example, the structure of an ASC X12N transaction includes variable-length fields, looping, hierarchical levels, paired data element keys and other elements that may be foreign to an entity's legacy system. In addition, the attributes and values of the data elements in each transaction may vary substantially from what an entity currently processes.

Translator software can be used to re-format an incoming standard claim or other standard transaction so that it can be understood by the legacy system. Likewise, a translator can reformat a proprietary outgoing transaction (such as a remittance advice or claim status response) so that it complies with HIPAA. While a translator can reformat data, it cannot create data that does not exist. For example, a translator could be used to assist entities in mapping national codes or other data elements on an incoming claim to nonstandard codes that may be used within the legacy system. However, translators cannot solve the problem that the industry faces with respect to elimination of proprietary codes in cases where no national code exists to replace the proprietary code. In other words, a translator can be used to crosswalk codes between a national code set list and a proprietary code set list, but the translator cannot actually create new codes where no national code exists.

Typically, a translator is packaged as an integrated suite of tools that includes not only the ability to transform data from one format to another but also includes other functionality such as mapping via GUI front-end, creation of a translation engine, messaging capability (ftp, smtp, http, etc), file transfer reconciliation, file validation to standards, data transfer security, and trading partner management.

2.2.2 Considerations for Use

There are two translator options readily available to DHS.

The first translator option is the SeeBeyond suite of products – *e*Gate and e*Exchange.* These are currently in place and operational on a limited basis at Health and Human Services Data Center (HHSDC).

The second option is to secure a new translator product, such as Microsoft BizTalk®, from the Department of General Services' (DGS) Cal-Store Catalog. Microsoft BizTalk® is used as an example of a translator because of its availability to the State; it is, however, only an example of many other similar products.

*E*Gate and e*Exchange by SeeBeyond*

SeeBeyond literature describes these products as - *an e-business integration solution, the SeeBeyond e-Business Integration Suite offers a rapidly deployable and scalable infrastructure for application integration, business-to-business connectivity and business processes optimization. With more than 13 years of experience, SeeBeyond has successfully integrated systems at more than 1,500 organizations worldwide*.

Although the SeeBeyond products are currently in place at HHSDC, several concerns exist in using the HHSDC translator as a potential solution.

- HHSDC has posted a HIPAA Translator Service, however, at this time HHSDC is not extending a service offering to new customers. A long-term delay in extending a service offering would impact the 834 Transaction compliance solution implementation schedule.

- The SeeBeyond product functionality is more robust then needed for the required transactions. CA-DHS transaction requirements are for the most part, outbound transactions that are simpler to implement than inbound transactions.

- A significant amount of effort is necessary in order to map proprietary formats within the product. Mapping between disparate formats is a combination of both graphical user interface (GUI)-based drag-and-drop methodologies and coding logic effort. Development efforts have required more coding logic than originally anticipated.

- The SeeBeyond product offers a new technology for the HHSDC staff, thereby causing support for the product to be resource-intensive.

BizTalk® Accelerator for HIPAA by Microsoft

From Microsoft product literature - *BizTalk® Accelerator for HIPAA offers a complete enterprise platform, a product set that can be deployed rapidly, downloadable schema updates, and the combined expertise of Washington Publishing Company (WPC)—the exclusive publisher of the X12N Implementation Guides adopted under HIPAA—and Microsoft. BizTalk® Accelerator mitigates the risks associated with achieving HIPAA transaction compliance by helping healthcare organizations to achieve transaction accuracy, minimize the costs of ongoing maintenance, adapt to future rule changes, and prepare for the possibility of governmental auditing. It provides the foundation for creating healthcare without boundaries through open standards-based communication and system interoperability. Additionally, BizTalk® Accelerator is a powerful, easy-to-use solution that makes achieving HIPAA compliance easier and more cost-effective*.

BizTalk® can be procured from the DGS CalStore catalog. However, the following concerns exist in using the BizTalk® translator as a potential solution.

- DHS would bear the full cost of the translation software, licensing fees, and version update charges. These costs would be in addition to expenditures already made by the State to purchase SeeBeyond. HIPAA release maintenance would be an on-going obligation, in terms of procurement expense, time, and resources.

- Development staff with specific product expertise would either need to be recruited by participating staff, or an equitable arrangement for sharing existing staff resources would need to be established.

- BizTalk® functionality is more robust than needed for the required transactions. The functionality over and above that needed may prove to be an additional burden.

2.3 Integrate Extract, Transform and Load (ETL) Software

2.3.1 Description

ETL software is the singular process of converting data from one format to another. The actual transformation can be accomplished either by in-house development via legacy coding or by acquiring third-party software. Third-party ETL software is available that provides a narrower focus than that of the translator products which typically bring many components together in one package to provide an end-to-end solution.

Commercial ETL software now generally include a GUI-based front-end for defining, describing, and mapping the inputs and the outputs. Drag-and-drop capabilities along with extensive user-definable coding permit almost limitless capability to convert from any-to-any file formats. This includes the ability to convert from many-to-one or one-to-many formats. The outcome of this mapping would be an executable map that could be imbedded and processed dynamically in an ongoing production basis. Add-ins are available for the software that supports HIPAA-specific data formats such as the 834 Enrollment/Disenrollment Transactions.

2.3.2 Considerations for Use

Unlike a clearinghouse option with its ongoing monthly and transaction fees, ETL software is purchased once and incurs no ongoing transaction fees other than yearly maintenance fees. Consideration for using ETL software is predicated on the presence of pre-existing DHS legacy processes for creating, transporting, and archiving files for the health and dental plans or creation of new processes to support those activities. Data transformation then becomes an intermediate step between FAME file creation and FAME file delivery. In this instance, in addition to delivering the FAME file to health and dental plans, a HIPAA compliant 834 Transaction would also be part of the delivery package.

Validation is a necessary component before delivering a HIPAA-compliant 834 Transaction. This functionality is typically not included in ETL offerings, but is available in other software tools. Validation software, such as *Edifecs*, is available at HHSDC and may be imbedded along with the data transformation process. *Edifecs* has become the *de facto* HIPAA validation tool standard and is used by the Centers for Medicare & Medicaid Services (CMS) as the CMS complaint management and data validation portal. The *Edifecs* product is also used by the HIPAA Conformance Certification Organization (HCCO) in their Common Compliance Acceptance Program (CCAP).

The ETL development tool is typically hosted on a client/server system. Once the desired mapping is achieved, an executable is created and then is wrapped and ported

to other platforms. Existing system processes would be modified to accommodate the new transformation and validation steps.

Unlike a translation product suite that includes more functionality than is required, the ETL product is acquired for the discrete purpose of converting from one format to another. ETL software are mature products and coupled with add-ins for HIPAA transactions offer a low-cost alternative to a complete translation product suite.

The integration of ETL software would enhance the existing processes by providing a means of converting from one file layout to another file layout. DHS would use this functionality for decreasing development time for the FAME extract into an 834 Transaction. Additional functionality can be provided with supporting products that perform compliance checking of the generated output file against the seven types of testing, trading partner management, transaction archival and reconciliation.

2.3.3 ETL Software Technologies

Product information was collected for third-party ETL software from vendor publications and is presented without modification in the following section. The software included in this list represent the multiple ETL software products available for State procurement.

djCosmos by ***Pervasive Software***

> Pervasive Software solutions provide a cost-effective and flexible alternative to other EDI packages for companies either wanting to enter EDI or seeking a more simplified way of conducting their in-house EDI transactions. With Pervasive, the necessary IT resources typically needed for integrating EDI functionality are greatly reduced. Pervasive enables any application or data source for EDI, allowing for the exchange of electronic documents over a wide variety of technologies for data transport. With Pervasive's djCosmos, you can design and implement an EDI solution to meet your specific needs.
>
> Pervasive's djCosmos, provides a comprehensive and entirely configurable design and execution environment. djCosmos gives you the tools and solutions that enable you to create and manage the fundamental data integration tasks that assist your business, regardless of size, in solving today's complex integration challenges. Covering both the extract transformation load (ETL) and enterprise application integration (EAI) solutions space, djCosmos provides unmatched strength in connectivity, data mapping and transformation, standards support, and management of integration process flow.
>
> Additional information may be found on the web: http://www.pervasive.com

Hummingbird ETL by ***Hummingbird Ltd.***

Hummingbird is a leader in the Enterprise Information Management Systems (EIMS) market. EIMS technologies enable organizations to manage business content throughout the entire lifecycle as a mission-critical knowledge asset, streamline business processes, and optimize knowledge transfer within the extended enterprise.

Data Integration tools such as Hummingbird ETL are used to extract, transform and load data from original sources into a consolidated data warehouse where various forms of analysis can be performed upon it. Hummingbird ETL is a powerful data integration solution that spans the functional areas of ETL and EAI. It transforms, cleanses, enriches and directs information across the entire spectrum of decision support systems and corporate applications, for projects that might include data warehouses or data marts.

Additional information may be found on the web: http://www.hummingbird.com/

DataStage™ TX by ***Ascential Software***

Ascential DataStage TX provides support for industry standards and connectivity requirements so you can solve critical business problems in real time. Ascential DataStage TX's Solutions-Oriented Architecture is open and scalable, which means we can rapidly adapt our technology to meet specific industry needs - so you can accelerate implementation, reduce risks, and increase operational efficiencies.

Ascential DataStage TX delivers the ability to easily and seamlessly automate high-volume, complex transactions without the need for additional coding-resulting in a quick return on investment. Ascential DataStage TX 6.7 delivers rapid ROI through a highly scalable, open architecture.

Additional information may be found on the web: http://www.ascential.com

2.4 Develop Custom Legacy Translator

2.4.1 Description

This alternative would entail the creation and administration of a complete software life cycle for the design, development, test and implementation effort of a customized translator. Development would center on creating new mainframe applications that supplement existing FAME file generation processes. The purpose of the translator would be to take the existing FAME file and create the appropriate HIPAA compliant transaction set. The translator design and logic would be based on the currently defined Implementation Guide for the 834 Transaction set.

Processes would also need to be established for handling trading partner setup and administration, error checking and reporting, compliance checking to standards, and scheduling.

2.4.2 Considerations for Use

This option would permit DHS to design and implement an 834 Transaction exactly to the current mandated specifications using new and as yet undeveloped legacy processes. However, in doing so, the ITSD Program Area would be required to participate in varying aspects, and with varying levels of effort in the analysis, design, development, testing and implementation of the new processes. These efforts would be required in addition to existing workloads all of which would have an impact on the ITSD Program Area.

In addition, new skill sets that focus on the development of EDI transactions would need to be acquired. There are also inherent difficulties with native coding of an X12N format. Typically, native coding techniques do not lend themselves to the intricacies of transaction looping structures. Once implemented there would be an ongoing maintenance effort to comply with mandated transaction releases and the application of new code sets as required.

2.5 Retain Status Quo

2.5.1 Description

Under this scenario, there would be no change in business or system procedural processes currently in place. Both COHS and non-COHS would continue to receive the FAME file extracts in the same format and on the same frequency as today.

2.5.2 Considerations for Use

This scenario is provided only as a contingency plan. HIPAA law, Section 1176, establishes severe civil monetary penalties for non-compliance on mandated transactions and the Secretary of Health and Human Services may impose these civil money penalties on entities that violate standards. In addition, the potential for loss of Federal funding exists.

Although enforcement activities will focus on obtaining voluntary compliance through technical assistance, there is a process that is primarily complaint driven and consists of progressive steps that provide opportunities to demonstrate compliance or submit a corrective action plan.

As currently defined, the mandated 834 Transaction cannot adequately meet both DHS and HCP needs. Critical data such as DHS' usage of ethnicity code and alien code cannot be accommodated on the 834 Transaction. Moving away from the status quo will place an additional burden upon both DHS and HCPs to accept and process this type of data in supplemental files.

3 Comparative Alternative Evaluations

The following is a side-by-side comparison of each alternative solution category based on selected criteria. The criteria are limited to Complexity, Resources and Skills, Time Table, Cost, and Risk. Within each category, several products or services may be reviewed that further qualify the selection.

Product examples used in the previous section of this document may be carried through to this section for the purpose of serving as examples and references.

Factors outside the scope of this project may also affect the ultimate selection and implementation of the 834 Transaction compliance solution.

Symbols are used within the table headings that rank the relative rating within the category for each solution. The meaning of each symbol is defined as:

Symbol	Rating	Description
	Excellent	Product or service offering demonstrated a strong ability to meet OHC's requirements; function, feature or service offering stood above the other alternatives in scope and flexibility.
	Above Average	Product or service offering demonstrated ability to meet OHC's requirements; additional functions, features or service offerings were available; exceeded expectations.
	Average	Product or service offering demonstrated an average level of ability to meet OHC's requirements.
	Below Average	Product or service offering demonstrated a poor ability to meet OHC's requirements; limited or undesirable functions, features or workarounds.
	Not Available	Product or service offering could not demonstrate ability to meet OHC's requirements; workarounds were unacceptable, or relative cost was too high.

A complete matrix for all solutions is presented in Solution Alternatives – Relative Rankings that shows the relative rankings across all categories. An overall ranking and relative score are also presented in the matrix. The **overall ranking** is derived from an average of the ratings for the solution while the **relative ranking** is assigned based on comparative values across categories; where a rank of 1 is higher than a rank of 5.

3.1 Complexity

Clearinghouse	Translator	Software Tools Integration	Legacy Translator
System complexities are minimal by having an external entity perform the implementation of an 834 Transaction using their services for delivering compliant transactions. The clearinghouse assumes the responsibility for knowing and understanding looping structures and for applying maintenance updates as required. Ancillary services such as secure file delivery, compliance checking and audit ability are all performed by the clearinghouse. Complexity is the same whether a Northrop-Grumman / DoD, or EDS, or ACS solution is used. All offer established and experienced end-to-end clearinghouse data translation solutions.	A translator solution is complex to use when mapping a transaction. Once implemented, this solution is tightly coupled and integrated which mitigates ongoing system complexities. As a single-solution, tight integration is achieved in the file translation, compliance checking, audit ability, and file transfer functionalities.	Complexity in this solution is reduced by the functionality of the software tool chosen. Tools would reduce the knowledge level required to format complex looping structures by providing an interface to the user. Once developed, the translation engine is then incorporated into existing processes. With the availability of optional HIPAA Adapters the mappings are quicker to develop. Project management could be incorporated that would keep both internal Program Areas and external vendors focused on meeting deployment dates.	Although this approach would be imbedded into existing legacy processes, the looping structures inherent in 834 Transactions are not the simple structures typically found in legacy systems. They are complex and once designed, developed and implemented are subject to mandated periodic maintenance updates. These mandates typically require rapid implementation and deployment that the Program Area would be responsible for implementing. This solution presents the highest complexity.

Comparative Rating Scale

Excellent Above Average Average Below Average Poor/Not Available

3.2 Resources and Skills

Clearinghouse	Translator	Software Tools Integration	Legacy Translator
This approach presents the lowest requirement in resource and skill set utilization. The clearinghouse provides the necessary expertise to perform the one-time mapping and the ongoing production maintenance. There would be a need for project management resources and Program Area resources on an ongoing basis.	This approach would require that new skill sets be developed in-house. Third-party vendors would be required to install, develop, and implement Biztalk. There is not a wide body of industry specific knowledge for the product. Training for in-house resources to provide ongoing operational support would be required.	This approach would require that new skill sets be developed in-house. Third-party vendors would be required to install, develop, and implement these tools. There is not a wide body of industry specific knowledge for the product.	This solution represents the highest requirement in resources and skill set utilization. There would be a need for a legacy core team composed of analysts, developers and testers with a high-level knowledge of the ITSD Program Area systems.

Comparative Rating Scale

Excellent Above Average Average Below Average Poor/Not Available

3.3 Time Table

Clearinghouse	Translator	Software Tools Integration	Legacy Translator
A clearinghouse would provide the most expedited route towards a final solution. Extended procurement delays could affect implementation schedule.	A translator solution offers some schedule relief in that implementation tasks are part of a more defined implementation package. The required implementation tasks focus on connectivity between translator and proprietary data, translation mapping and business process remediation activities. At this time HHSDC is not extending a service offering to new customers.	Time to deploy is greater than that of a clearinghouse. Utilization of experienced vendors to develop and implement would ensure a quicker ramp-up time to implementation.	This could potentially be the longest time towards implementation requiring full life cycle methodologies. The greatest impact would be in the time spent acquiring knowledge and expertise in properly applying EDI transaction looping structures.

Comparative Rating Scale

Excellent Above Average Average Below Average Poor/Not Available

3.4 Cost

Clearinghouse	Translator	Software Tools Integration	Legacy Translator
Costs for a clearinghouse solution would begin at approximately $100,000 and could potentially go much higher. Use of different solutions for other transaction types could drive the cost up significantly. The clearinghouse solution provides the least up-front costs in terms of acquisition and implementation. However, long-term ongoing transaction fees could mitigate the initial low buy-in costs. There are no other hardware or firmware costs other than providing a secure file delivery mechanism. There is a wide disparity in the transaction fees charged by the clearinghouses. Fees range from a low of $.02 per transaction to a high of $.15 per transaction.	Costs for a translator could range from $30K to $100K. Hardware and firmware are not included in the cost structure. There would not be the ongoing transaction fees that are typically associated with the clearinghouse model. In this model, additional internal resources and project management resources would be necessary and no costing has been included. If a third-party translator product offering is used then the acquisition, implementation, and training costs would be about $30K. All of these models rely on third-party involvement and additional costs may be incurred beyond those associated with implementation tasks.	Costs for Tools Integration would range from $80K to $100K for the software and implementation. These costs are based on current CMAS vendor contracts. There would not be ongoing transaction fees that are typically associated with the clearinghouse model. This costing model is based on 1 time acquisition, implementation, and training costs. Hardware and firmware acquisition, yearly maintenance fees and internal resources and project management costs were not included. As with the translator model, additional internal resources and project management resources would be necessary and no costing has been included. Compliance checking capability is usually not part of ETL solutions. This model relies on third-party involvement and additional costs may be incurred beyond those associated with implementation tasks.	Costs for a legacy application solution could exceed $200K. There would not be the ongoing transaction fees that are typically associated with the clearinghouse model. This solution provides the greatest direct cost. Most of these costs are attributed to internal resources learning and applying the complex coding techniques of HIPAA transaction looping structures and fully testing every possible combination. There would also be ongoing resource costs associated with applying maintenance releases for the HIPAA transactions.

3.5 Risk

Clearinghouse	Translator	Software Tools Integration	Legacy Translator
The clearinghouse solution presents a moderate to high risk. There is risk in placing the development, ongoing processing, and maintenance as outsourced activities to outside vendors. However, the risk is mitigated by the placement within an experienced EDI clearinghouse. The Northrop-Grumman / DoD solution poses the least amount of risk when considering the relatively low up-front development costs and the no-cost processing fees. However, other factors significantly increase the risk for this vendor. An *EDS* solution presents a diminished risk from that of Northrop-Grumman in that EDS is familiar with Medicaid Program processes and there are already established lines of communication. The *ACS* solution involves considerable risk in that they have not yet done an 834 Transaction for a client.	The translator solution presents a moderate degree of risk yet higher than that of a clearinghouse. Time to implement a compliant transaction is longer than that of a clearinghouse. There is a greater risk the translator may not accommodate all Program Area business processes which would not be discovered until well underway in the development effort. Translators are built on new technology platforms. Skills for these new platforms are generally not found in Program Area legacy operations. There is a level of risk in obtaining third-party expertise to develop, implement and train on any of the translators. There is a high level of risk until HHSDC can provide a service level offering for its translator.	Integration of a new software tool presents a moderate degree of risk. The system tools approach relies on acquiring third-party software to fulfill a singular function. Because this tool requires other third-party applications to gain HIPAA compliance there is an inherent risk that neither vendor would be responsive to a problem in a timely fashion. Time to implement a compliant transaction is longer than that of a clearinghouse. There is also the greater risk a tool may not accommodate idiosyncrasies of the Program Area processes that wouldn't be discovered until well underway in the development effort. Current transformation tools are built on new technology platforms. Skills for these new platforms are generally not found in Program Area legacy operations. At some time this knowledge would need to be acquired by the Program Area.	This solution presents the greatest risk and yet the least exposure to outside vendors. Development by and for legacy applications lends itself well to successful completion by experienced Program Area Subject Matter Experts. This solution would be an extension of existing legacy architecture using the same development and testing tools currently in place. These development and testing methodologies are well understood by the Program Area resources; and under this approach less junior legacy resources could be utilized. The greatest risk is one of extended development time and the subsequent time to implement this solution. The looping structures inherent in EDI transactions are complex and do not lend themselves well to typical legacy program flows. Program Areas would be responsible for the periodic HIPAA guideline updates and subsequent remediation to the legacy applications.

Comparative Rating Scale

Excellent Above Average Average Below Average Poor/Not Available

3.6 Solution Alternatives – Relative Rankings

Evaluation Criteria	Clearinghouse		Translator	ETL Tool	Legacy Translator
	ACS	EDS			
Complexity					
Business, system and transaction					
Resources & Skills					
Availability & knowledge level					
Time Frame					
Time to deploy solution					
Cost [1]					
First year costs (834)	$2,170,000	$471,940	NA	$168,800	$706,000
1st thru 6th year total costs	$12,970,000	$2,160,000	NA	$270,400	$741,100
Risk					
Overall risk that could affect deployment					
Overall Ranking					
Relative Ranking 1=most desirable, 5=least desirable	5	2	3	1	4

Comparative Rating Scale

Excellent Above Average Average Below Average Poor/Not Available

[1] An HHSDC service offering is unavailable and precludes assigning a true cost. Figures provided are only for proposed transaction fees

4 Recommended Solutions

Based on alternatives investigated there are three solutions best suited to meet the needs of DHS in gaining compliance for the 834 Benefit Enrollment and Disenrollment Transaction. Recommendations are ranked in order of cost/benefit preference.

Solution 1 - Integrate ETL and compliance checking software tool into system processes.

This approach would offer the least complex solution by outsourcing development to product specialists and retaining operations in-house. This same approach minimizes the exposure to external risk factors that DHS might encounter and provides a shortened implementation time frame than could be realized with an in-house legacy solution.

On these merits, it is recommended that DHS procure ETL software and employ a compliance checking software tool.

The combination of these two tools would permit the translation of the FAME file to an 834 Transaction and also provide Type 1 through Type 7 compliance checking. All other secure file delivery aspects of the current legacy system would remain in place. The combination of software tools and service offering delivers only that functionality required as opposed to purchasing a data translation product suite with functionality that will never be used and is difficult to implement.

The greatest risk in implementing this solution is the dependency on an outside vendor to provide a solution.

Solution 2 – Utilize Clearinghouse Services

The benefit of this solution would be rapid development and deployment utilizing existing EDI support structures. The HIPAA maintenance and compliance burden is borne by the vendor and relieves DHS of that responsibility.

A risk associated with this solution is the on-going transaction fees, which could change based on transaction volume expectations. It is on this basis that this solution is less desirable than Solution 1.

Furthermore, there would be additional costs in mapping the proprietary file formats. Of greater concern is the risk associated with protecting the confidentiality of individually identifiable health information when outsourced to a third party.

Solution 3 – Utilize In-house Translator

The prime benefit of using the SeeBeyond product is in currently having it in place at HHSDC. However, as previously stated, there are several high risk factors associated with using the HHSDC translator as a potential solution. It is these high risk factors that place this solution as the least desirable of the three recommended solutions.

5 Solution Alternatives, Evaluation & Recommendations Approval

We have reviewed the 834 Solution Alternatives, Evaluation & Recommendations document and hereby approve it.

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Lisa Murphy, Chief, ITSD Medi-Cal Programming Unit

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Reyanne Walker, Chief, ITSD Medi-Cal Eligibility Data Support Unit

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Russ Hart, Chief, PSD OHC Technology Section

6 Attachments

Attachment A – Detailed Six-Year Projected Costs showing categorized expenditure factors for each solution and the associated costs.

Attachment B – Six-Year Projected Cost Trends showing the six-year cost trend for each of the solutions.

Attachment A – Detailed Six-Year Projected Costs

Projected costs for a six-year period are presented here as a method for comparing selected solutions. Several projections are shown to present the cumulative cost effect of adding HIPAA transactions other than the 834 Transaction to the mix.

For those solutions other than a clearinghouse solution the total cost of ownership may be softened with the addition of transactions other than the 834 Transaction. In this case the marginal unit cost for adding a transaction is reduced by the experience level gained on the first transaction implementation. Although there are differences in transaction content among the different transactions, once the basic concept of EDI transactions is understood and applied to new applications, the learning curve and the time to implement is reduced. There is also logic code that may be shared among the transactions that could further reduce the development time.

The following tables introduce detailed pricings for implementation of different solutions.

- Attachment Table 1 – Alternative Costing (834 Transaction Only)
- Attachment Table 2 – Alternative Costing (834 & 820 Transactions)
- Attachment Table 3 – Alternative Costing (834, 820 , 270/271 Transactions)

Attachment Table 1 – Alternative Costing (834 Transaction Only)

1st Year Projection	Clearinghouse			In-House	
	ACS	EDS	ETL Tool	HHSDC	Legacy
Software Acquisition			$71,800		$3,000
Hardware & Firmware			$80,000		
Training			$5,000		$1,000
Implementation			$12,000		
Yearly Maintenance Fee					
Transaction Mapping	$10,000	$37,440			
Transaction Fee Rates	0.15	0.03		0.04	
834 (14.4 mil per year)	$2,160,000	$432,000		$576,000	
Trading Partner Setup	$50	$50			
834 (59)		$2,500			
Software Development (9,000 hr)					$702,000
1st Year Total	$2,170,050	$471,990	$168,800	$576,000	$706,000

2nd-6th Year Projection	Clearinghouse			In-House	
	ACS	EDS	ETL Tool	HHSDC	Legacy
Accumulated Maintenance Fee			$78,980		
Transaction Fee Rate	$0.15	$0.03		$0.04	
834 (72 mil)	$10,800,000	$2,160,000		$2,880,000	
Software Maintenance			$10,920	$10,920	$11,700
Standards Release Update			$11,700	$11,700	$23,400
2nd - 6th Year Total	$10,800,000	$2,160,000	$101,600	$2,902,620	$35,100
1st - 6th Year Total	$12,970,050	$2,631,990	$270,400	$3,478,620	$741,100

Attachment Table 2 – Alternative Costing (834 & 820 Transactions)

1st Year Projection	Clearinghouse		In-House		
	ACS	EDS	ETL Tool	HHSDC	Legacy
Software Acquisition			$71,800		$3,000
Hardware & Firmware			$80,000		
Training			$5,000		$1,000
Implementation			$12,000		
Yearly Maintenance Fee					
Transaction Mapping	$10,000	$37,440			
Transaction Fee Rates	0.15	0.03		0.04	
834 (14.4 mil per year)	$2,160,000	$432,000		$576,000	
820 (24,000 per year)	$3,600	$720		$960	
Trading Partner Setup	$50	$50			
834 (59)		$2,500			
820 (200)		$10,000			
Software Development (10,000 hr)					$780,000
1st Year Total	$2,173,650	$482,710	$168,800	$576,960	$784,000

2nd-6th Year Projection	Clearinghouse	In-House			
	ACS	EDS	ETL Tool	HHSDC	Legacy
Accumulated Maintenance Fee			$78,980		
Transaction Fee Rate	$0.15	$0.03		$0.04	
834 (72 mil)	$10,800,000	$2,160,000		$2,880,000	
820 (120,000)	$18,000	$3,600		$4,800	
Software Maintenance			$10,920	$10,920	$11,700
Standards Release Update			$11,700	$11,700	$23,400
2nd - 6th Year Total	$10,818,000	$2,163,600	$101,600	$2,907,420	$35,100
1st - 6th Year Total	$12,991,650	$2,646,310	$270,400	$3,484,380	$819,100

Attachment Table 3 – Alternative Costing (834, 820 , 270/271 Transactions)

1st Year Projection	Clearinghouse		In-House		
	ACS	EDS	ETL Tool	HHSDC	Legacy
Software Acquisition			$71,800		$3,000
Hardware & Firmware			$80,000		
Training			$5,000		$1,000
Implementation			$12,000		
Yearly Maintenance Fee					
Transaction Mapping	$10,000	$37,440			
Transaction Fee Rates	0.15	0.03		0.04	
834 (1,4.4 mil per year)	$2,160,000	$432,000		$576,000	
820 (24,000 per year)	$3,600	$720		$960	
270/271 (3.6 mil per year)	$540,000	$108,000		$144,000	
Trading Partner Setup	$50	$50			
834 (59)		$2,500			
820 (200)		$10,000			
270/271 (11)		$550			
Software Development (12,000 hr)					$936,000
1st Year Total	$2,713,650	$591,260	$168,800	$720,960	$940,000

2nd-6th Year Projection	Clearinghouse		In-House		
	ACS	EDS	ETL Tool	HHSDC	Legacy
Accumulated Maintenance Fee			$78,980		
Transaction Fee Rate	$0.15	$0.03		$0.04	
834 (72 mil)	$10,800,000	$2,160,000		$2,880,000	
820 (120,000)	$18,000	$3,600		$4,800	
270/271 (18 mil)	$2,700,000	$540,000		$720,000	
Software Maintenance			$10,920	$10,920	$11,700
Standards Release Update			$11,700	$11,700	$23,400
2nd - 6th Year Total	$13,518,000	$2,703,600	$101,600	$3,627,420	$35,100
1st - 6th Year Total	$16,231,650	$3,294,860	$270,400	$4,348,380	$975,100

Attachment B – Six-Year Projected Cost Trends

Overall, the incremental costs incurred over the six-year period are relatively small. In general, the initial procurement or development effort is a major factor in the baseline cost. The one exception is the clearinghouse solution where the greatest expense is attributed to the ongoing transaction fees. Within the clearinghouse solutions there is a wide disparity in the transaction costs that greatly affects the lifetime total cost.

Three separate trend-line graphics are presented that individually plot aggregate costs for each solution against the other solutions over a six-year period. Each trend-line graphic depicts the marginal cost of adding HIPAA transactions to the mix.

Figure 1 depicts the relative costs for implementing only an 834 Transaction solution.

Figure 2 represents the relative costs for implementing not only an 834 Transaction but also an 820 Transaction.

Figure 3 delineates the relative costs for implementing an 834 Transaction, an 820 Transaction and the 270/271 Transactions.

Solutions labeled ‘ACS’ and ‘EDS’ represent the example clearinghouse solution. Costs are scaled to a fixed number of transactions over the six-year period. The single greatest cost for this solution is the ongoing transaction fee charged for each transaction processed.

The solution labeled ‘ETL’ represent the extract, transformation, and load software tool. The initial costs of procurement and implementation are the major cost while the ongoing annual maintenance expenses are relatively flat line.

The solution labeled ‘HHSDC’ is based on using the SeeBeyond translator currently in limited use. The initial costs of development and implementation are lower than other solutions. However, the differences between the higher transaction fees charged by HHSDC and those charged by the clearinghouses drive the overall cost upwards at a rate faster than those experienced by the clearinghouse solution.

The solution labeled ‘Legacy’ has a very high startup cost that would cover the analysis, design, code and test effort required to implement this solution.

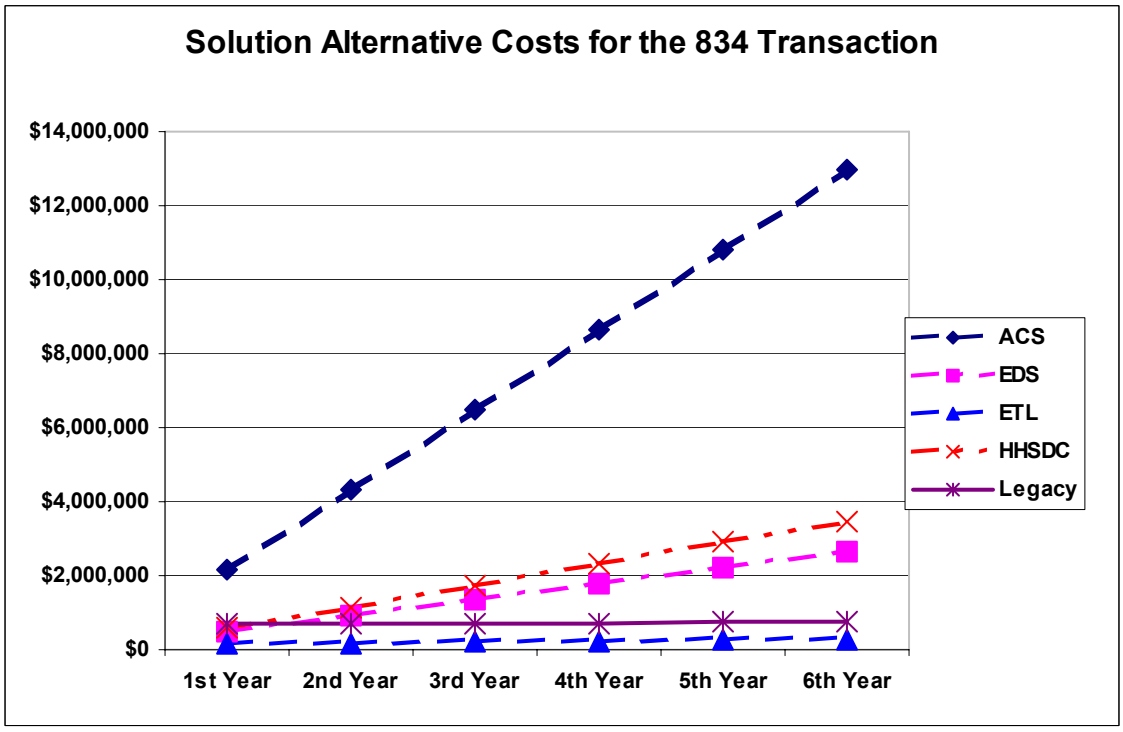

Figure 1

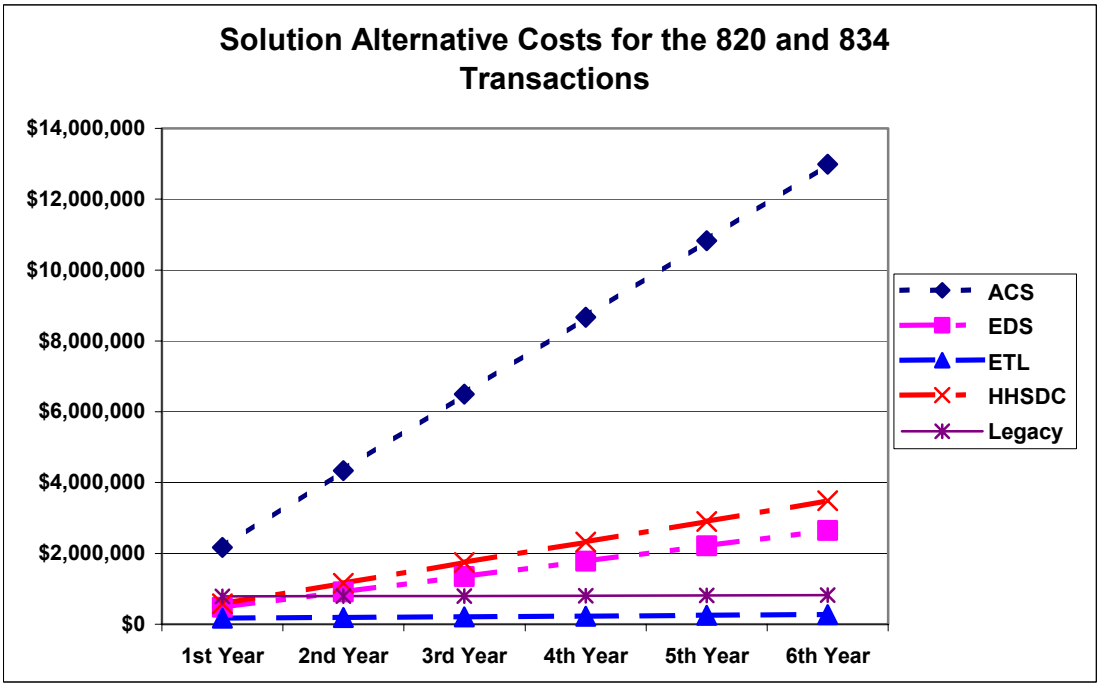

Figure 2

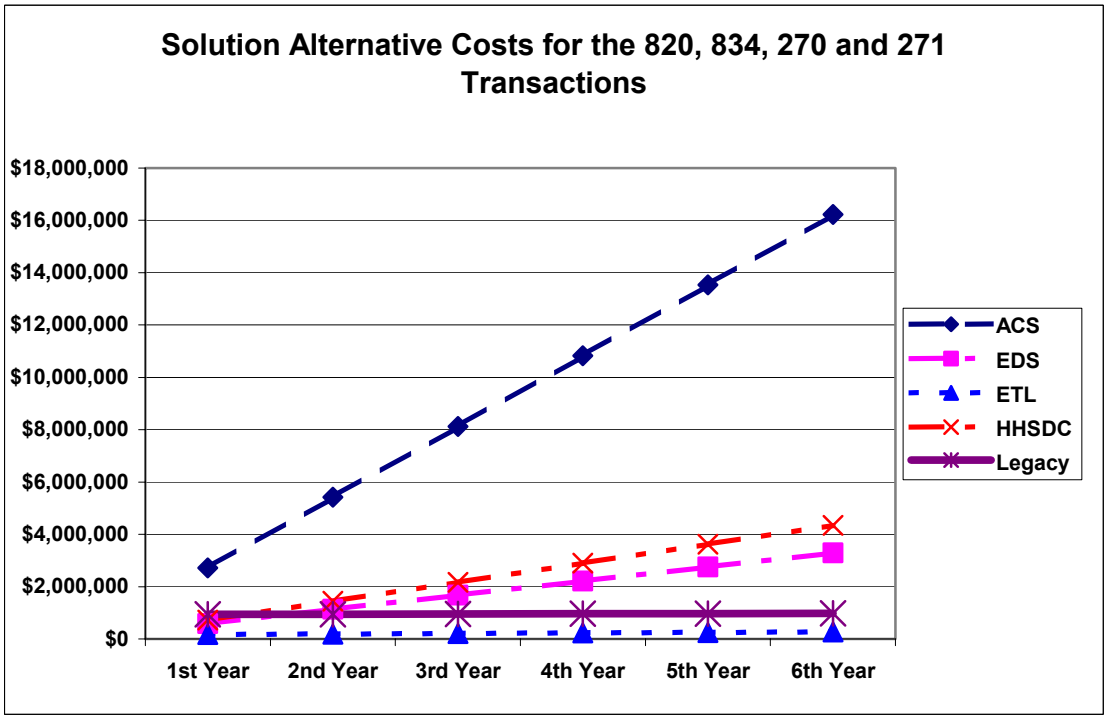
Solution Alternative Costs for the 820, 834, 270 and 271 Transactions
$18,000,000
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
1st Year
2nd Year
3rd Year
4th Year
5th Year
6th Year
ACS
EDS
ETL
HHSDC
Legacy

Figure 3